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PTO/SB/21 (09-06)


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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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<b>TRANSMITTAL FORM</b> (to be used for all correspondence after initial filing)		Application Number	10/634,964
		Filing Date	Aug 5, 2003
		First Named Inventor	Liu, Zhendong
		Art Unit	1765
		Examiner Name	Patricia A. George
Total Number of Pages in This Submission	13	Attorney Docket Number	02039US

ENCLOSURES (Check all that apply)		
<input checked="" type="checkbox"/> Fee Transmittal Form <input type="checkbox"/> Fee Attached <input type="checkbox"/> Amendment / Reply <input type="checkbox"/> After Final <input type="checkbox"/> Affidavits/declaration(s) <input type="checkbox"/> Extension of Time Request <input type="checkbox"/> Express Abandonment Request <input type="checkbox"/> Information Disclosure Statement <input type="checkbox"/> Certified Copy of Priority Document(s) <input type="checkbox"/> Reply to Missing Parts/Incomplete Application <input type="checkbox"/> Reply to Missing Parts under 37 CFR 1.52 or 1.53	<input type="checkbox"/> Drawing(s) <input type="checkbox"/> Licensing-related Papers <input type="checkbox"/> Petition <input type="checkbox"/> Petition to Convert to a Provisional Application <input type="checkbox"/> Power of Attorney, Revocation <input type="checkbox"/> Change of Correspondence Address <input type="checkbox"/> Terminal Disclaimer <input type="checkbox"/> Request for Refund <input type="checkbox"/> CD, Number of CD(s) _____ <input type="checkbox"/> Landscape Table on CD	<input type="checkbox"/> After Allowance communication to (TC) <input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences <input checked="" type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief) <input type="checkbox"/> Proprietary Information <input type="checkbox"/> Status Letter <input type="checkbox"/> Other Enclosure(s) (please identify below):
Remarks		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT			
Firm Name	Rohm and Haas Electronic Materials CMP Holdings, Inc.		
Signature			
Printed name	Blake T. Blederman		
Date	May 8, 2007	Reg. No.	34,124

CERTIFICATE OF TRANSMISSION/MAILING			
I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.			
Signature			
Typed or printed name	Barbara A. Wiley	Date	May 8, 2007

This collection of information is required by 37 CFR 1.5. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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PTO/SB/17 (07-06)

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Effective on 12/08/2004. Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818). <b>FEE TRANSMITTAL</b> <b>For FY 2007</b>		<b>Complete If Known</b> Application Number 10/634,984 Filing Date 8/5/2003 First Named Inventor Liu Examiner Name Patricia A. George Art Unit 1765 Attorney Docket No. 02039US	
<input type="checkbox"/> Applicant Claims small entity status. See 37 CFR 1.27			
<b>TOTAL AMOUNT OF PAYMENT</b> (\$ 500.00)			

**METHOD OF PAYMENT (check all that apply)**

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): \_\_\_\_\_  
☒ Deposit Account Deposit Account Number 500618 Deposit Account Name: Rohm and Haas Electronic Materials CMP Holdings, Inc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☒ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, except for the filing fee  
☒ Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

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**FEE CALCULATION****1. BASIC FILING, SEARCH, AND EXAMINATION FEES**

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	\$ 0.00

**2. EXCESS CLAIM FEES****Fee Description**

Each claim over 20 (including Reissues)

Fee (\$)	Small Entity Fee (\$)
50	25

Each independent claim over 3 (including Reissues)

200	100
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Multiple dependent claims

360	180
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**Total Claims****Extra Claims****Fee (\$)****Fee Paid (\$)****Multiple Dependent Claims****Fee (\$)****Fee Paid (\$)**
 - 20 or HP = 0 x \$50.00 = \$ 0.00  
 HP = highest number of total claims paid for, if greater than 20.
**Indep. Claims****Extra Claims****Fee (\$)****Fee Paid (\$)**
 - 3 or HP = 0 x \$200.00 = \$ 0.00  
 HP = highest number of independent claims paid for, if greater than 3.
**3. APPLICATION SIZE FEE**

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41 (a)(1)(G) and 37 CFR 1.16(s).

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof	Fee (\$)	Fee Paid (\$)
- 100 = 0	/ 50 = 0	(round up to a whole number) x	\$250.00	\$ 0.00

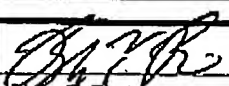
**4. OTHER FEE(S)**

Non-English Specification, \$130 fee (no small entity discount)

Other: (e.g., late filing surcharge): Appeal Brief

Fees Paid (\$)

\$500.00

<b>SUBMITTED BY</b>			
Signature		Registration No. 34,124 (Attorney/Agent)	Telephone 302-283-2138
Name (Print/Type)	Blake T. Biederman	Date	May 8, 2007

This collection of information is required by 37 CFR 1.138. The information is required to obtain or retain a benefit by the public when it is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.15. This collection is estimated to take 30 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Liu	
Application No.: 10/634,964	Art Unit: 1765
Filed: 1/23/2003	Examiner: Patricia Ann George
Title: COMPOSITION FOR REDUCING EROSION IN SEMICONDUCTOR WAFERS	
Attorney Docket No.: 02039US	
Commissioner for Patents P.O. Box 1450 Alexandria, VA 22313-1450	

APPEAL BRIEF

Applicant respectfully appeals the rejection dated February 5, 2007 and advisory action dated March 26, 2007.

(1) REAL PARTY IN INTEREST

The real party in interest in this appeal is Rohm and Haas Electronic Materials CMP Holdings, Inc.

(2) RELATED APPEALS AND INTERFERENCES

There is no related appeal or interference.

(3) STATUS OF CLAIMS

Claims 1, 2 and 4 to 6 – Rejected and Appealed.

Claims 3 and 7 – Cancelled.

Claims 8 to 10 – Withdrawn.

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(4) STATUS OF AMENDMENTS

Claim 5 amendment after final rejection denied.

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**(5) SUMMARY OF THE CLAIMED SUBJECT MATTER****Claim 1**

Claim 1 covers an aqueous chemical mechanical planarizing composition (Para. 12, lines 1 and 2). The composition comprises an oxidizer for promoting barrier removal (Para 26, lines 1 and 2); an abrasive (Para 21, lines 1 and 2); an inhibitor for decreasing removal of a metal interconnect (Para 27, lines 8 to 10); and water soluble polymaleic acid (Para. 19, lines 1 and 2). The chemical mechanical planarizing composition has a pH of less than 4 (Para. 30, line 1) adjusted with an inorganic pH adjusting agent, the inorganic pH adjusting agent being an acid (Para. 29, lines 1 and 2). And the composition has a tantalum nitride removal rate of at least eighty percent of copper removal rate at a pad pressure of 13.8 kPa (Para. 34, lines 1 to 4).

**Claim 5**

Claim 5 covers an aqueous chemical mechanical planarizing composition (Para. 12, lines 1 and 2). The composition comprises 0.05 to 15 wt% abrasive (Para. 22, line 1); 0.1 to 10 wt% oxidizing agent (Para. 26, lines 9 and 10); 0.0025 to 2 wt% of benzotriazole (Para. 28, lines 3 and 6 to 8); and 0.01 to 5 wt% of water soluble polymaleic acid (Para. 17, lines 1 and 2 and Para. 19, lines 1 and 2). The pH of the composition is less than 4 (Para. 30, line 1) adjusted with an inorganic pH adjusting agent (Para. 29, lines 1 and 2), the inorganic pH adjusting agent including an acid selected from nitric acid, sulfuric acid, hydrochloric acid and phosphoric acid (Para. 29, lines 2 to 4). And the composition has a tantalum nitride removal rate of at least ninety[eighty] percent of copper removal rate at a pad pressure of 13.8 kPa (Para. 34, lines 1 to 4).

**(6) GROUNDS OF REJECTIONS TO BE REVIEWED ON APPEAL**

1. Claims 1, 2 and 4 to 6 stand rejected under 35 U.S.C. §103 (a) over Sun et al. (US Pat. No. 6,709,316) in view of Sherber et al. (US Pat. No. 5,858,813) as evidenced by Changzhou Keji Chemical Co. (Product Detail Poly (Maleic Acid)) and Wikipedia, Maleic Acid.

**(7) ARGUMENT**

**I. Rejection of claims 1, 2 and 4 to 6 over Sun et al. in view of Sherber et al. as evidenced by Changzhou Keji Chemical Co. (Product Detail Poly (Maleic Acid)) and Wikipedia, Maleic Acid.**

The combined references fail to establish a prima facie case of obviousness. In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992). Applicant has discovered that polymaleic acid in combination with inorganic acid, low pH, an inhibitor and abrasive particles improves dielectric erosion when polishing barrier layers of patterned wafers. The rejection relies upon selecting properties from three distinct slurries within a single reference. In particular, Sun et al. disclose three distinct slurries for different polishing applications as follows:

- 1) Bulk copper slurry—Col. 7, lines 9 to 12 (*abrasive*), Col. 6, lines 57 to 59 (*oxidizer*), Col. 6, lines 59 to 65 (*benzotriazole inhibitor*), Col. 6, line 66, Col. 7, lines 1 to 3 and Col. 7, lines 3 to 4 of Sun et al. (*inorganic and/or organic acids—phosphoric acid*).
- 2) First copper CMP slurry—Col. 7, line 59 of Sun et al. (*phosphoric/nitric acid*).
- 3) Barrier slurry selectivity for tantalum—Col. 3, lines 32 to 34 of Sun et al. (*barrier selectivity*).

A critical step in analyzing the patentability of claims pursuant to section 103(a) is casting the mind back to the time of invention, to consider the thinking of one of ordinary skill in the art, guided only by the prior art references and the then-accepted wisdom in the field, In re Kotzab, 217 F.3d 1365, 1370, 55 USPQ2d 1313, 1316 (Fed. Cir. 2000). As noted in the attached 132 Declaration of Dr. Liu, a skilled slurry design scientist would not expect or attempt to use a first-step copper slurry for second-step polishing that requires high removal rates of barrier materials, such as tantalum nitride. Thus, the selective combining of several distinct slurries with non-analogous polymer art fails to establish a prima facie case of obviousness.

It is well established that a compound and its properties are inseparable. In re Papesch, 315 F.2d 381, 137 USPQ2d 43 (CCPA 1963). Part of evaluating the invention as a whole includes considering functional language. In re Caldwell, 319 F.2d 254, 138 USPQ 243 (CCPA

1963) recognizes the propriety of defining an invention by what it does. In summary, the combined references fail to recognize using polymaleic acid in combination with inorganic acid, low pH, an inhibitor and abrasive particles to provide an effective barrier removal slurry that achieves a tantalum nitride removal rate of at least eighty percent of copper removal rate at a pad pressure of 13.8 kPa.

In addition, the combined references teach away from the claimed invention. It is well accepted that proceeding contrary to conventional wisdom represents strong evidence of unobviousness. In re Hedges, 783 F.2d 1038, 228 USPQ 685, 687 (Fed. Cir. 1986). Specifically, the Sun et al. and Scherber et al. patents teach away from the claimed invention as follows:

1) The rejection refers to bulk copper slurry—Col. 7, lines 9 to 12 (*abrasive*), Col. 6, lines 57 to 59 (*oxidizer*), Col. 6, lines 59 to 65 (*benzotriazole inhibitor*), Col. 6, line 66, Col. 7, lines 1 to 3 and Col. 7, lines 3 to 4 of Sun et al. (*inorganic and/or organic acids—phosphoric acid*). Since bulk copper slurries tend to remove copper as fast as possible with minimal barrier removal it teaches away from the claimed barrier removal slurry that achieves a tantalum nitride removal rate of at least eighty percent of copper removal rate at a pad pressure of 13.8 kPa. Furthermore, “a skilled slurry design scientist would not expect or attempt to use a first-step copper slurry for second-step polishing that requires high removal rates of of barrier materials, such as tantalum nitride—paragraph 6 of the 132 Declaration of Dr. Liu.

2) Sun et al. teach a preferred pH range of 8 to 12 for its selective barrier removal step—see Col. 9, lines 54 to 65. This teaches away from the claimed pH range of less than 4.

3) The Examples of Scherber et al. teach a slurry that selectively removes aluminum (interconnect) in view of a titanium (barrier). These Examples are the opposite and teach away of the claimed barrier removal slurry that achieves a tantalum nitride (barrier) removal rate of at least eighty percent of copper (interconnect) removal rate at a pad pressure of 13.8 kPa.

The action combines the copper bulk copper and copper barrier slurries with the genus “maleic acid derivatives” from the Markush group at Col. 5, lines 43 to 58 of the Scherber et al. aluminum slurry. “The fact that a claimed species or subspecies is encompassed by a prior art genus is not sufficient by itself to establish a prima facie case of obviousness.” In re Baird, 16 F.3d 380, 382, 29 USPQ2d 1550, 1552. Furthermore, the fact that a claimed compound may be

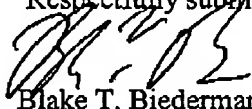
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encompassed by a generic formula does not by itself render that compound obvious. In re Jones, 958 F.2d 347, 350, 21 USPQ2d 1941, 1943 (Fed Cir. 1992).” Scherber et al. disclose maleic acid derivatives, but they do not disclose or suggest the use of a polymaleic acid polymer.

In addition, the action applies an inappropriate “obvious to try” standard that represents an insufficient basis to form a prima facie case of obviousness. In moving from the prior art to the claimed invention, one cannot base a determination of obviousness on what the skilled person might try or find obvious to try. Both the suggestion and the expectation of success must be found in the prior art. In re Dow Chemical Co., 837 F.2d 469, 473, 5 USPQ2d 1529, 1531 (Fed. Cir. 1987). Sun et al. disclose slurries designed for bulk copper, first copper and a selective barrier slurry and Scherber et al. disclose an aluminum polishing slurry—see Examples. In agreement with the 132 Declaration of Dr. Liu, it would not be obvious for a skilled scientist in the area of slurry development to selectively pick and choose features from four distinct slurries to form a barrier slurry. Furthermore, Sun et al. in combination with Scherber et al. do not suggest attempting polishing tantalum barriers with polymaleic acid in combination with inorganic acid, low pH, an inhibitor and abrasive particles to provide an effective barrier removal slurry that achieves reduced dielectric erosion in combination with the claimed tantalum nitride removal rate of at least eighty percent of copper removal rate at a pad pressure of 13.8 kPa.

Respectfully submitted,



Blake T. Biederman

Attorney for Applicants

Registration No. 34,124

Telephone No.: (302) 283-2136

Rohm and Haas Electronic Materials CMP Holdings, Inc.  
451 Bellevue Road  
Newark, DE 19713

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CLAIMS APPENDIX

1. An aqueous chemical mechanical planarizing composition comprising:  
an oxidizer for promoting barrier removal;  
an abrasive;  
an inhibitor for decreasing removal of a metal interconnect; and  
water soluble polymaleic acid and wherein the chemical mechanical planarizing composition has a pH of less than 4 adjusted with an inorganic pH adjusting agent, the inorganic pH adjusting agent being an acid; and a tantalum nitride removal rate of at least eighty percent of copper removal rate at a pad pressure of 13.8 kPa.
2. The composition of Claim 1, wherein the polymaleic acid comprises a homopolymer or a copolymer.
3. Cancelled.
4. The composition of Claim 1, having a pH of 1.5 to less than 4.
5. An aqueous chemical mechanical planarizing composition comprising:  
0.05 to 15 wt% abrasive;  
0.1 to 10 wt% oxidizing agent;  
0.0025 to 2 wt% of benzotriazole; and  
0.01 to 5 wt% of water soluble polymaleic acid, and wherein the pH of the chemical mechanical planarizing composition is less than 4 adjusted with an inorganic pH adjusting agent, the inorganic pH adjusting agent including an acid selected from nitric acid, sulfuric acid, hydrochloric acid and phosphoric acid; and a tantalum nitride removal rate of at least ~~ninety~~  
eighty percent of copper removal rate at a pad pressure of 13.8 kPa.
6. The composition of Claim 5, wherein the polymaleic acid comprises a homopolymer or a copolymer.



**EVIDENCE APPENDIX**

Attached please find a copy of the 1.132 Declaration of Dr. Zhendong Liu.

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Applicant(s): Liu et al.

Application No.: 10/634,964

Filed: 2/27/2003

Title: CHEMICAL MECHANICAL  
PLANARIZATION COMPOSITIONS FOR  
REDUCING EROSION IN  
SEMICONDUCTOR WAFERSArt Unit:  
1765Examiner:  
Patricia Ann George

Attorney Docket No.: 02039US

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450**DECLARATION UNDER 37 C.F.R. § 1.132**

That I Zhendong Liu declare the following:

1) That I am a current employee of Rohm and Haas Electronic Materials CMP Inc. (fka Rodel, Inc.); and that I have been employed at Rohm and Haas Electronic Materials for over four years in the role of a research chemist.

2) That my professional qualifications include the following:

Ph.D. University of California, Berkeley, 2001

Major: Hydrometallurgy

Minors: Chemistry and Environmental Engineering

Block Grant Fellowship, 1997-1998

Jane Lewis Fellowship, 1998-2001

M.S. Beijing Graduate School, China University of Mining and Technology, 1997

Major: Mineral Processing Engineering

B.S. Huainan Mining Institute, 1994

Major: Mineral Processing Engineering

3) That I co-authored the following articles related to Chemical Mechanical Polishing:

Z. Liu et al., "Electrochemical Testing of Tantalum and Copper in Chemical Mechanical Polishing Slurries", ECS Fall Meeting, Los Angeles, October 2005.

Z. Liu et al., "Copper Removal Rate Control in Chemical Mechanical Polishing of Barrier Materials, *CMP-MIC*, February 2005.

Z. Liu et al., "Copper CMP Barrier Slurries for Ultra-low k Applications", *CMP-MIC*, February 2004.

Z. Liu et al., "Development of Novel Barrier Slurries for Ultra-low k Applications", *CAMP Annual Meeting*, August 2003.

4) That I have reviewed US Pat. Appln. No. 10/634,964 ('964), filed August 5, 2003; the USPTO action mailed November 18, 2005; and Sun et al. (US Pat. No. 6,709, 316) and Yano et al. (US Pat. No. 6,375,545).

5) That Sun et al. at Col. 6, line 33 to Col. 8, line 39 disclose a first-step copper slurry designed for removing copper from semiconductor substrates. First-step copper slurries typically remove copper at a rate of 2,000 to 10,000 Å/min. Furthermore, these slurries ideally have a zero removal rate for barrier materials, such as tantalum and tantalum nitride.

6) That a skilled slurry design scientist would not expect or attempt to use a first-step copper slurry for second-step polishing that requires high removal rates of barrier materials, such as tantalum nitride.

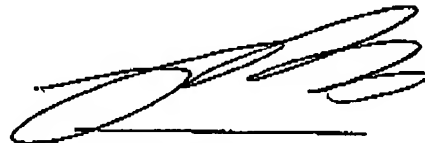
7) That Sun et al. at Col. 8, line 40 to Col. 9, line 65 disclose a barrier removal slurry that operates at a pH of about 4 to 12 and preferably at a pH of about 8 to 12.

8) That Yano et al. disclose at Col. 9, lines 20 to 29 the use of polymeric particles and at Col. 3, lines 8 to 29, the use of surfactant-coated polymeric particles. Yano et al. do not disclose the addition of water soluble carboxylic acid polymers to a slurry having a pH less than 4 with the pH adjusted with an inorganic acid and the slurry being useful for tantalum nitride removal.

9) That as illustrated by Examples 1 to 4 and Figures 1 to 3 of the pending application, Applicants have discovered that the addition of water soluble carboxylic acid polymers to a barrier slurry having a pH less than 4 with the pH adjusted with an inorganic acid can improve dielectric erosion when polishing patterned wafers.

10) That in my opinion, the combined Sun et al. and Yano et al. references do not disclose or suggest the addition of water soluble carboxylic acid polymers to a barrier slurry having a pH less than 4 with the pH adjusted with an inorganic acid.

11) That I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.



Dr. Zhendong Liu

February 10, 2006

**RELATED PROCEEDINGS APPENDIX**

None.